



ENERGY STAR[®] Program Requirements Product Specification for Set-top Boxes

Eligibility Criteria Draft 2 Version 3.0

1 Following is the Version 3.0 ENERGY STAR Product Specification for Set-top Boxes (STB). A product
2 shall meet all of the identified criteria if it is to earn the ENERGY STAR.

3 **1 DEFINITIONS**

4 A) Product Type (Base Type): The primary means of access to video content for a STB. All base types
5 may be configured as a simple STB that provides a single primary function, or as part of a complex
6 STB that provides a primary function and one or more additional functionalities.

7 1) Cable: A STB whose primary function is to receive television signals from a broadband, hybrid
8 fiber/coaxial, or community cable distribution system with conditional access (CA) and deliver
9 them to a consumer display, thin-client/remote STB, and/or recording device.

10 2) Satellite: A STB whose primary function is to receive television signals from satellites and deliver
11 them to a consumer display, thin-client/remote STB, and/or recording device.

12 3) Cable / Satellite Digital Transport Adapter (DTA): A minimally-configured STB with no Additional
13 Functionalities whose primary function is to receive television signals from (1) a broadband, hybrid
14 fiber/coaxial, or community cable distribution system or (2) a satellite distribution system, and
15 deliver them to a consumer display and/or recording device.

16 4) Internet Protocol (IP): A STB whose primary function is to receive television/video signals
17 encapsulated in IP packets and deliver them to a consumer display, thin-client/remote STB,
18 and/or recording device.

19 5) Terrestrial: A STB whose primary function is to receive television signals over the air (OTA) or via
20 community cable distribution system without conditional access (CA) and deliver them to a
21 consumer display, thin-client/remote STB, and/or recording device.

22 6) Thin-client / Remote: A STB that (1) is designed to interface between a Multi-room STB and a TV
23 (or other output device), (2) has no ability to directly interface with a Service Provider, and (3)
24 relies solely on a Multi-room STB for content. Any STB that meets the definition of a cable,
25 satellite, IP, or terrestrial STB is not a thin-client/remote STB.

26 B) Product Features:

27 1) Base Functionality: The primary functionality that defines the ENERGY STAR criteria applicable to
28 a particular STB. Base Functionality is one of the following: Cable, Satellite, IP, Terrestrial or Thin-
29 Client/Remote.

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31 2) Additional Functionality:

32 i) Advanced Video Processing: The capability to encode, decode, and/or transcode audio/video
33 signals in accordance with standards H.264/MPEG 4 or SMPTE 421M.

34 **Note:** *The AVP definition has been modified to include an explicit list of protocols that meet the definition
35 and intent of the “advanced” video processing TEC allowance. Stakeholders are welcome to suggest
36 other protocols for inclusion in the final draft specification, along with a technical justification for the need
37 for additional energy allowances.*

38 ii) CableCARD: The capability to decrypt premium audio/video content and services and provide
39 other network control functions via a plug-in conditional access module that complies with the
40 ANSI/SCTE 28 HOST-POD Interface Standard¹.

41 iii) Digital Video Recorder (DVR): The capability to store video in a digital format to a rewritable
42 disk drive or other non-volatile storage device integrated into a STB. This definition excludes
43 video capture software for personal computers or server-based DVR capabilities.

44 iv) DOCSIS®: The capability to distribute data and audio/video content over cable television
45 infrastructure in accordance with the CableLabs® Data Over Cable Service Interface
46 Specification².

47 v) High Definition (HD) Resolution: The capability to transmit or display video signals with
48 resolution greater than or equal to 720p.

49 vi) Home Network Interface: The capability to interface with external devices over a network via
50 IEEE 802.11 (WiFi), MoCA, or HPNA.

51 **Note:** *The HNI definition has been modified to include an explicit list of protocols that meet the definition
52 and intent of the home network interface TEC allowance. Stakeholders are welcome to suggest other
53 protocols for inclusion in the final draft specification, along with a technical justification for the need for
54 additional energy allowances.*

55 vii) Multi-room: The capability to provide independent audio/video content to multiple devices
56 within a single family dwelling. This definition does not include the capability to manage
57 gateway services for multi-subscriber scenarios.

58 viii) Multi-stream: The capability to deliver two or more simultaneous audio/video streams to a
59 consumer display, thin-client/remote STB, or recording device. The simultaneous streams
60 may be delivered via a physically separate input or via the primary input. This definition does
61 not include out-of-band tuners.

62 **Note:** *The “additional tuner” adder has been re-named “multi-stream” to allow IP STBs that offer similar
63 functionality without physically separate hardware to qualify for a TEC allowance.*

64 ix) Removable Media Player: The capability to decode digitized audio/video signals on DVD or
65 Blu-ray Disc optical media.

1 <http://www.scte.org/standards/>

2 <http://www.cablelabs.com/specifications/>

66 x) Removable Media Player / Recorder: The capability to decode and record digitized
67 audio/video signals on DVD or Blu-ray Disc optical media.

68 C) Automatic Power Down (APD): The capability of a device to switch itself from On mode to Sleep
69 mode after a predetermined period of time (APD timing) has elapsed. APD timing begins when the
70 following criteria have been met:

71 1) The device has ceased performance of all primary functions; or

72 2) The last user input has been received (e.g., remote control signal, volume adjustment).

73 D) Primary Function:

74 1) Delivery of live or recorded audio/video content to a thin-client/remote STB or local/remote
75 recording device is considered a primary function;

76 2) Delivery of live or recorded audio/video content to a consumer display within 4 hours of last user
77 interaction/input is considered a primary function;

78 3) Continuous device functions (e.g., clocks, status displays, indicator lamps) are NOT considered
79 primary functions.

80 **Note:** *The definitions of APD and Primary Function have been updated / added to align with the definitions*
81 *in the ENERGY STAR Audio/Video specification.*

82 E) Operational Modes:

83 1) On Mode: Where the product is connected to a mains power source, has been activated and may
84 be providing one or more primary functions. The common terms “active”, “in-use” and “normal
85 operation” also describe this mode.

86 2) Sleep Mode: Where the product is connected to a mains power source, is not providing a primary
87 function, and offers one or more of the following user oriented or protective functions which may
88 persist for an indefinite time:

89 i) To facilitate the activation of other modes (including activation or deactivation of On mode) by
90 remote switch (including remote control), internal sensor, timer;

91 ii) Continuous function: information or status displays including clocks;

92 iii) Continuous function: sensor-based functions.

93 3) Deep Sleep State: A power state within Sleep Mode characterized by reduced power consumption
94 due to lack of network access and increased time required to return to full On Mode functionality.

95 **Note:** EPA is proposing a definition for “Deep Sleep” in this draft specification. The concept of Deep
96 Sleep was raised during previous stakeholder conference calls, and EPA expressed a desire to encourage
97 manufacturers to implement the capability for lower-power Sleep states in their products in a manner that
98 will not adversely impact the customer experience. To that end, two unique benefits are proposed in this
99 specification: First, service providers who deploy products with the capability for Deep Sleep are
100 rewarded with a 1.5X multiplier to count towards their annual purchase requirement (see the Service
101 Provider Partner Commitments document). Second, manufacturers who include Deep Sleep functionality
102 that is enabled by default are rewarded with a modified TEC equation (see Equation 3 in this specification)
103 for use in meeting product qualification criteria. EPA believes that these two incentives will expedite
104 greater availability of these energy savings features/approaches. EPA seeks feedback on the proposed
105 addition to this specification.

106 F) Other Definitions:

- 107 1) Service Provider: A business entity that provides audio/video content to subscribers with whom it
108 has an ongoing contractual relationship. A Service Provider distributes ENERGY STAR qualified
109 STBs to end users under a lease or rental arrangement.
- 110 2) Conditional Access: The encryption, decryption, and authorization techniques employed to protect
111 content from unauthorized viewing. CableCARD and Downloadable Conditional Access System
112 (DCAS) are examples of conditional access technology.
- 113 3) Digital Television Adapter (DTA): A device that receives terrestrial (over the air) digital signals and
114 converts them to an analog output suitable for analog TVs. DTAs do not provide digital signal
115 output. This definition does not include converters for satellite or cable digital signals or devices
116 that perform multiple functions (e.g., DVD players with DTA capability).
- 117 4) Game Console: A stand-alone device whose primary function is to process video game content.
118 The primary inputs for game consoles are special hand-held controllers rather than the mouse and
119 keyboard used by a conventional computer. Game consoles are equipped with audio/video
120 outputs for use with televisions as the primary display, rather than an external monitor or
121 integrated display. Game consoles typically do not use a conventional general-purpose operating
122 system, but often perform a variety of multimedia functions such as: DVD/CD playback, digital
123 picture viewing, and digital music playback.
- 124 5) Out-of-band Tuner: A tuner compliant with standards ANSI/SCTE 55-1 2002, ANSI/SCTE 55-2
125 2002, or similar, that is used to gain access to data channels outside of the primary audio/video
126 source signal. These tuners may facilitate two-way communication to allow a STB to exchange
127 data (e.g., diagnostics) with the Service Provider, and may enable access to Pay-Per-View or
128 other rich-media interactive content.
- 129 6) Typical Energy Consumption (TEC): A means for evaluating energy efficiency through a
130 calculation of expected energy consumption for a typical user over a one year period, expressed
131 in units of kWh/year.
- 132 7) Unit Under Test (UUT): The device being tested.

- 133 G) Product Family: A group of product models that are (1) made by the same manufacturer, (2) subject to
134 the same ENERGY STAR qualification criteria, and (3) of a common basic design. Product models
135 within a family differ from each other according to one or more characteristics or features that either
136 (1) have no impact on product performance with regard to ENERGY STAR qualification criteria, or (2)
137 are specified herein as acceptable variations within a product family. For Set-top Boxes, acceptable
138 variations within a product family include aesthetic housing changes that do not affect the thermal
139 characteristics of the device (e.g., color, labeling, or other cosmetic modifications).

140 **Note:** A STB Product Family definition is proposed here as a means of establishing which products can be
141 qualified and labeled as ENERGY STAR under a single qualified product submission. This proposal will
142 bring the STB specification in line with other ENERGY STAR consumer electronics specification revisions
143 for Enhanced Testing & Verification. Further information on this program-wide initiative can be found at
144 www.energystar.gov/testingandverification.

145 2 SCOPE

146 2.1 Included Products

147 2.1.1 Products that meet the definition of a Set-top Box Base Type as specified herein are eligible for
148 ENERGY STAR qualification, with the exception of products listed in Section 2.2.

149 2.2 Excluded Products

150 2.2.1 Products that are covered under existing ENERGY STAR product specifications are not eligible
151 for qualification under the STB specification. The list of specifications currently in effect can be
152 found at www.energystar.gov/products.

153 3 QUALIFICATION CRITERIA

154 3.1 Significant Digits and Rounding

155 3.1.1 All calculations shall be performed with actual measured or observed values. Only the final result
156 of a calculation shall be rounded. Calculated results shall be rounded to the nearest significant
157 digit as expressed in the corresponding specification limit.

158 3.1.2 Unless otherwise specified, compliance with specification limits shall be evaluated using exact
159 values without any benefit from rounding.

160 **Note:** The preceding language has been added to bring the STB specification in line with other consumer
161 electronics specification revisions in support of the ENERGY STAR Enhanced Testing & Verification
162 initiative.

163 3.2 General Qualification Criteria

164 3.2.1 External Power Supply: If a product is shipped with an EPS, the EPS shall meet the level V
165 performance requirements under the International Efficiency Marking Protocol and include the
166 level V marking. Additional information on the Marking Protocol is available at
167 www.energystar.gov/powersupplies.

168 3.2.2 Maintenance Activities:

169 i. Products may automatically exit Sleep Mode on a regular schedule to download content, scan
170 for program and schedule information, and perform maintenance activities. The total time
171 spent in this state should not exceed an average of two hours in any 24-hour period, exclusive
172 of activities scheduled by the end-user (e.g., video recording of a regularly scheduled
173 program). Video downloads that are not user-requested (e.g., “speculative recording”, or
174 “push”) should be counted against the two hour average per day requirement.

175 ii. Products that have exited Sleep Mode and completed download/scan activities should
176 automatically return to Sleep Mode in less than 15 minutes.

177 iii. Products that provide a speculative recording function shall provide a user-accessible menu
178 option to permit users to disable the functionality. Instructions for disabling speculative
179 recording shall be included in printed and/or electronic product manuals.

180 3.2.3 Auto Power Down (APD): Products that offer an APD feature shall meet the following
181 requirements:

182 i. Products shall be shipped from the manufacturer with APD enabled by default, with APD
183 timing set to engage after a period of inactivity less than or equal to 4 hours.

184 ii. All energy-related default settings shall persist until an end-user chooses to manually either
185 (1) disable APD, or (2) modify the default settings.

186 3.3 Typical Energy Consumption (TEC) Requirements

187 3.3.1 Combined TEC ($TEC_{COMBINED}$), as determined in Section 3.3.2 shall be less than or equal to the
188 Maximum TEC Requirement (TEC_{MAX}), as determined in Section 3.3.3.

189 3.3.2 Combined TEC shall be calculated per Equation 1.

190 Equation 1: Calculation of Combined TEC ($TEC_{COMBINED}$)

$$191 \quad TEC_{COMBINED} = TEC_{PRIMARY} + TEC_{PLAY/REC}$$

192 *Where:*

- 193 • $TEC_{PRIMARY}$ is the Primary TEC calculated per Equation 2, Equation 3, or
194 Equation 4; and
- 195 • $TEC_{PLAY/REC}$ is the Playback/Record TEC calculated per Equation 5.

196 i. For products with no default APD and no default Deep Sleep, Primary TEC ($TEC_{PRIMARY}$) shall
197 be calculated per Equation 2.

198 Equation 2: Calculation of Primary TEC ($TEC_{PRIMARY}$) for Products with 199 No Default APD and No Default Deep Sleep

$$200 \quad TEC_{PRIMARY} = 0.365 \times ((14.0 \times P_{TV}) + (10.0 \times P_{SLEEP}))$$

201 *Where:*

- 202 • P_{TV} is the measured power in On Mode (W); and
- 203 • P_{SLEEP} is the measured power in Sleep Mode (W).

204 ii. For products with default APD and no default Deep Sleep, Primary TEC ($TEC_{PRIMARY}$) shall be

205 calculated per Equation 3.

206 **Equation 3: Calculation of Primary TEC ($TEC_{PRIMARY}$) for Products with**
207 **Default APD and No Default Deep Sleep**

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$$TEC_{PRIMARY} = 0.365 \times ((7.0 \times P_{TV}) + (10.0 \times P_{SLEEP}) + (7.0 \times P_{APD}))$$

209 *Where:*

- 210 • P_{TV} is the measured power in On Mode (W);
- 211 • P_{SLEEP} is the measured power in Sleep Mode (W); and
- 212 • P_{APD} is the measured power after APD (W).

213 iii. For products with default APD and default Deep Sleep, Primary TEC ($TEC_{PRIMARY}$) shall be
214 calculated per Equation 4.

215 **Equation 4: Calculation of Primary TEC ($TEC_{PRIMARY}$) for Products with**
216 **Default APD and Default Deep Sleep**

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$$TEC_{PRIMARY} = 0.365 \times ((7.0 \times P_{TV}) + (6.0 \times P_{SLEEP}) + (4.0 \times P_{DEEP_SLEEP}) + (7.0 \times P_{APD}))$$

218 *Where:*

- 219 • P_{TV} is the measured power in On Mode (W);
- 220 • P_{SLEEP} is the measured power in Sleep Mode (W);
- 221 • P_{DEEP_SLEEP} is the measured power in Deep Sleep State (W); and
- 222 • P_{APD} is the measured power after APD (W).

223 **Note:** The preceding equations (Eq. 1 through Eq. 4) have been added to this specification to clarify
224 requirements and to incorporate TEC benefits for Deep Sleep state, as noted previously.

225 iv. For products with DVR, Removable Media Playback, or Removable Media Playback / Record
226 capabilities, Playback/Record TEC ($TEC_{PLAY/REC}$) shall be calculated per Equation 5, with
227 weightings for Playback and Record mode as specified in Table 1. Only one playback/record
228 function may be selected per product. For all other products, Playback/Record TEC
229 ($TEC_{PLAY/REC}$) shall be equal to zero.

230 **Equation 5: Calculation of Playback/Record TEC ($TEC_{PLAY/REC}$)**
231 **For Products with DVR or Removable Media Player**

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$$TEC_{PLAY/REC} = 0.365 \times [((P_{PLAYBACK} - P_{TV}) \times H_{PLAYBACK}) + ((P_{RECORD} - P_{TV}) \times H_{RECORD})],$$

233 *Where:*

- 234 • $P_{PLAYBACK}$ is the measured power during recorded video playback (W);
- 235 • P_{RECORD} is the measured power during video recording (W); and
- 236 • $H_{PLAYBACK}$ and H_{RECORD} are weightings for time spent in playback and record,
237 as specified in Table 3.

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Table 1: Weightings for Playback/Record TEC Calculation

Function	DVR	Removable Media Playback	Removable Media Playback w/ Record
Playback Duration (H _{PLAYBACK})	2.0 hrs/day	2.0 hrs/day	2.0 hrs/day
Record Duration (H _{RECORD})	3.0 hrs/day	0	1.0 hrs/day

240 3.3.3 The Maximum TEC Requirement (TEC_{MAX}), shall be calculated per Equation 6.

241 **Equation 6: Calculation of Maximum TEC Requirement (TEC_{MAX})**

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$$TEC_{MAX} = TEC_{BASE_MAX} + \sum_{i=1}^n TEC_{ADDL_i}$$

243 *Where:*

- 244 • *TEC_{BASE_MAX} is the Base Type TEC Allowance (kWh); and*
 245 • *TEC_{ADDL_i} is each applicable Additional Functionality TEC Allowance (kWh).*

246 i. The Base Type TEC Allowance (TEC_{BASE_MAX}) shall be as specified in Table 2, subject to the
247 following requirements:

248 a. If the STB meets the definition of Cable / Satellite DTA base type, the Base
249 Functionality shall be CABLE / SATELLITE DTA.

250 b. If the STB meets the definition of Cable STB base type, and/or the STB is capable of
251 receiving cable service after installation of a CableCARD or other type of conditional
252 access system, the Base Functionality shall be CABLE.

253 c. If the STB Base Functionality is not CABLE, and the STB meets the base type
254 definition of Satellite STB, the Base Functionality shall be SATELLITE.

255 d. If the STB Base Functionality is not CABLE, SATELLITE, or CABLE / SATELLITE
256 DTA, and the STB meets the base type definition of IP STB, the Base Functionality
257 shall be IP.

258 e. If the STB Base Functionality is not CABLE, SATELLITE, CABLE / SATELLITE DTA,
259 or IP, and the STB meets the base type definition of Terrestrial STB, the Base
260 Functionality shall be TERRESTRIAL.

261 f. If the STB Base Functionality is not CABLE, SATELLITE, CABLE / SATELLITE DTA,
262 IP, or TERRESTRIAL, and the STB otherwise meets the base type definition of Thin-
263 Client/Remote, the Base Functionality shall be THIN-CLIENT / REMOTE.

264 **Note:** *The TEC allowances in Table 2 have been updated based on continued stakeholder discussions.*
265 *EPA welcomes additional feedback on these proposed requirements.*

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Table 2: Base Type TEC Allowance (TEC_{BASE_MAX})

Base Functionality	Version 3.0 Allowance (kWh/year)	Version 4.0 Allowance (kWh/year)
Cable	60	50
Satellite	70	55
Cable / Satellite DTA	35	24
Internet Protocol (IP)	45	35
Terrestrial	22	18
Thin-client / Remote	35	25

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ii. Additional Functionality TEC Allowances (TEC_{ADDD_i}) shall be as specified in Table 3, subject to the following requirements:

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a. Additional functionality allowances shall not be applied to STBs with CABLE / SATELLITE DTA base functionality.

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b. The ADVANCED VIDEO PROCESSING, HOME NETWORK INTERFACE, HIGH DEFINITION, REMOVABLE MEDIA PLAYER, and REMOVABLE MEDIA PLAYER/RECORDER allowances are the only additional functionality allowances that may be applied to STBs with THIN CLIENT / REMOTE base functionality.

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c. The ADVANCED VIDEO PROCESSING allowance may only be applied once per STB, regardless of the number of advanced video processing options offered by the device.

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d. The CableCARD allowance may only be applied once per STB, regardless of the number of CableCARDS installed in the STB.

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e. The DOCSIS allowance may only be applied to STBs that are installed in a Service Provider network with DOCSIS capability.

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f. The HIGH DEFINITION (HD) allowance shall not be applied to STBs with TERRESTRIAL base functionality.

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g. The MULTI-ROOM allowance may only be applied once per STB, regardless of the number of remote outputs served by the device.

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h. The MULTI-ROOM allowance may not be combined with the HOME NETWORK INTERFACE allowance on a single device.

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i. The MULTI-STREAM allowances may only be applied once per STB, regardless of the number of simultaneous streams supported by the device.

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Note: The preceding requirements for application of additional functionality allowances to specific base types and the associated TEC allowances in Table 3 have been updated based on further review of current product feature sets and energy performance. EPA welcomes additional feedback on these proposed requirements.

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Table 3: Additional Functionality TEC Allowance (TEC_{ADDL_i})

Additional Functionality	Version 3.0 Allowance (kWh/year)	Version 4.0 Allowance (kWh/year)
Advanced Video Processing	12	8
CableCARD	15	15
Digital Video Recorder (DVR)	45	36
DOCSIS®	20	15
High Definition (HD)	25	16
Home Network Interface	10	5
Multi-room	40	35
Multi-stream – Cable/Satellite	16	13
Multi-stream – Terrestrial/IP	8	6
Removable Media Player	8	8
Removable Media Player / Recorder	10	10

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3.4 Products with Multi-room Capability:

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3.4.1 Products with Multi-room capability shall be evaluated for ENERGY STAR qualification per the following requirements:

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i. If the Combined TEC for the product as tested in single-output configuration is less than or equal to the Maximum TEC Requirement minus the Multi-room additional functionality allowance, the product may be qualified for ENERGY STAR for use in any configuration (e.g., single-TV installations or multi-room installations).

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ii. For products that can support a second N/ATSC display output over standard RF cabling with without the need for a Thin Client, if the Combined TEC for the product as tested in dual-output configuration is less than or equal to the Maximum TEC Requirement plus one half (50%) of the Thin Client / Remote base functionality allowance, the product may be qualified for ENERGY STAR in a Multi-room configuration. Partner shall clearly indicate in product literature that the product qualifies for ENERGY STAR only when providing content to more than one TV.

338 **5 USER INTERFACE**

339 5.1.1 Partners are encouraged to design products in accordance with the user interface standard IEEE
340 P1621: Standard for User Interface Elements in Power Control of Electronic Devices Employed in
341 Office/Consumer Environments. For details, see <http://eetd.LBL.gov/Controls>.

342 **6 EFFECTIVE DATE**

343 6.1.1 Effective Date: The Version 3.0 ENERGY STAR Set-top Box specification shall take effect on the
344 dates specified in Table 5. To qualify for ENERGY STAR, a product model shall meet the
345 ENERGY STAR specification in effect on its date of manufacture. The date of manufacture is
346 specific to each unit and is the date (e.g., month and year) on which a unit is considered to be
347 completely assembled.

348 6.1.2 Future Specification Revisions: EPA reserves the right to change this specification should
349 technological and/or market changes affect its usefulness to consumers, industry, or the
350 environment. In keeping with current policy, revisions to the specification are arrived at through
351 stakeholder discussions. In the event of a specification revision, please note that the ENERGY
352 STAR qualification is not automatically granted for the life of a product model.

353 **Table 5: Specification Effective Dates**

Product Type	Version 3.0 Effective Date	Version 4 Effective Date
All Products	TBD (2011)	TBD (2013)

354 **Note:** Specification effective dates for Version 3.0 and Version 4 are still to be determined. EPA
355 anticipates completing these specification revisions by December, 2010, and anticipates a Version 3.0
356 effective date no earlier than September, 2011.

357 **7 FUTURE SPECIFICATION REVISIONS**

358 7.1.1 EPA intends to investigate the following topics during the next revision of the STB specification:

359 i. Delete the removable media playback/record options from the TEC assessment due to lack of
360 relevance to the STB market.

361 ii. Implement a mandatory Deep Sleep requirement for all qualifying STBs.